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Citation for final published version:

Martinat, Stanislav, Navratil, Joseph, Hollander, Justin B., Trojan, Jakub, Klapka, Pavel, Klusacek, Petr and Kalok, David 2018. Re-reuse of regenerated brownfields: lessons from an Eastern European post-industrial city. *Journal of Cleaner Production* 188 , pp. 536-545.
10.1016/j.jclepro.2018.03.313 file

Publishers page: <https://doi.org/10.1016/j.jclepro.2018.03.313>
<<https://doi.org/10.1016/j.jclepro.2018.03.313>>

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This is pre-publication author-version of a manuscript which has been accepted for publication in Journal of Cleaner Production
doi: <https://doi.org/10.1016/j.jclepro.2018.03.313>
(Available online from March 31, 2018)
The manuscript did undergo copyediting, typesetting, and review of the resulting proof before it was published in its final form.

Re-reuse of regenerated brownfields: Lessons from an Eastern European post-industrial city

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Abstract

Brownfields constitute a substantial portion of the land area in post-industrial cities. Many brownfields have been regenerated for various uses, addressing a range of extant problems in urban areas. However, re-use plans for current brownfields are driven by market demand and public sector prioritization and do not always meet the requirements of local residents and visitors. In this paper, we investigate how a range of brownfields re-use options are perceived by residents and visitors to the Landek area in the city of Ostrava (Czech Republic). By analysing the results of the questionnaire survey (n=180) we found that future brownfields uses such as culture/sport and children's park are the most popular options. We found that gender was a statistically significant predictor of preferred reuse options. Women are strong supporters of the above-mentioned re-use options, while men tend to favour re-use options which promote industry. Remarkably, respondents, in general, lacked concrete ideas

concerning alternative re-use options of brownfields, suggesting that professional urban planners can be of assistance in the planning of the future use of brownfield sites.

Keywords

Regeneration of brownfields, re-use options, perception, urban renewal, Czech Republic

1. Introduction

Brownfields are properties both within cities and countryside that had a previous economically viable use, but have since been vacated and may be contaminated (Alker et al., 2000; Otsuka et al., 2013). Scholars have been studying this phenomenon for more than a decade. Key questions explored in this respect include future use of such sites and who decides upon that use (De Sousa, 2003; Donadieu, 2006; Hollander, 2009; Sardinha et al., 2013). Eastern European countries offer a unique perspective on the brownfields phenomenon, where socio-economic and political development during the second half of the 20th century has resulted in drastic growth in the number of brownfields, especially after 1990, and the development of new frameworks for local decision-making around land use (Frantal et al., 2013; Pfeil Somlyódyne, 2017).

Brownfields regeneration may take on many different forms – with a range of land uses (residential, commercial, industrial, or even parks and open space) and different intensities of regeneration – small-scale pocket parks to massive new mixed-use communities (Loures et al., 2016; Newton, 2013). With a couple of decades of research on brownfields behind us, it is clear that re-use plans have not always met community needs and that contemporary political systems in territories like Eastern Europe present opportunities to understand better the ways how the reuse possibilities and state interferences in brownfields issues differ in different parts of the world (Cheng et al., 2011; Scott and Kuhn, 2012).

With growing environmental awareness in Eastern Europe, brownfields have become an issue of strong interest among the general public (Franklin et al., 2017) and opportunities for improving the public's role in the decision making regarding brownfield regeneration processes have been sought (Glumac et al., 2015). Indeed, the range of attitudes and perceptions of brownfields and their reuse is quite extensive (Maliene et al., 2012; McCarthy, 2002). Brownfields represent an important feature of contemporary urban landscapes that can be integrated into broader discussions about how political innovations in Eastern Europe (and elsewhere) might be enhanced to better shape the planning of future development and quality of life in individual cities (Alexandrescu et al., 2016; Kabai, 2017; Wedding and Crawford-Brown, 2007).

In this paper, we sought to understand how people view reuse options for brownfields and their broader views on the political frameworks for applying those views to public decision-making. Our research questions are:

- What is the level of satisfaction with the present reuse of a brownfield?
- What are the main forces shaping the structure of preferences for re-reuse of a brownfield?

Answering these questions is the main objective of the paper.

We have chosen the area of the former coal mine Landek (Ostrava, Czech Republic) as the case study, where a museum focused on the history of mining and an outdoor amusement park are currently operating. The remainder of the paper is organised in the following way. After the introduction the conceptual background is put forward and theoretical issues are discussed in section 2. Section 3 introduces the area under study and provides necessary context with regard to the objectives of the paper. Section 4 describes the methodology used in the paper in order to answer the above-mentioned research question including the parameters of the questionnaire survey and the statistical processing of gathered information. Section 5 includes the results of our research. The concluding section 6 sums up some practical and theoretical implications of our research.

This paper will address the following main topics:

- * The conceptual background of our study is presented in Section 2.
- * Section 3 introduces the brownfield property which is the subject of the study.
- * Section 4 introduces the research methodology.
- * We ask the following questions in Section 5: What is the level of satisfaction with present reuse of brownfield? What are the main forces shaping structure of preferences for re-reuse of brownfield?
- *Section 6 presents our conclusions and implicatons for practice and theory.

2. Conceptual background

The problem of brownfields resonates in a public debate with a different intensity and with various nuances in different parts of the world, thus the section below provides a roadmap to these differences and the key questions that frame this study (Cao and Guan, 2007; Newton, 2010; Portney, 2005; Thornton et al., 2007).

2.1. Brownfields regeneration in post-socialist cities

It is indisputable that brownfields constitute an important element in the space of contemporary cities (Alexandrescu et al., 2014). This might be particularly seen in the post-socialist industrial cities where an enormously intense industrialisation occurred during the most of the 20th century (especially during the era of communism).

The process of industrialisation was subsequently followed by similarly intensive tendencies towards deindustrialisation after the fall of the Iron Curtain that ended up in a massive abandonment of industrial sites and an occurrence of enormous numbers of brownfields after 1990 (Krzysztofik et al., 2016). In the inner structure of such cities, for example Ostrava in the Czech Republic (Nekolova et al., 2016; Rumpel and Slach, 2012), Katowice in Poland (Krzysztofik et al., 2017), Kosice in Slovakia (Stasakova and Kulla, 2016) or Miskolc in Hungary (Czako, 2013), brownfields are omnipresent and they have become a part of everyday life of the local population and communities. However, as evidenced in studies by Kunc, et al. (2014b) and Rizzo et al. 2015), close proximity to brownfields may contribute to socio-pathological behaviour by residents (Kunc et al., 2014b; Rizzo et al., 2015). This phenomenon also negatively influences real estate prices in the immediate surroundings (Frantal et al., 2015). Thus, it is important to reuse brownfield sites to avoid or reduce the spatial concentration of the above-mentioned negative phenomena.

To make the specifics of the Eastern European context more understandable, it must be also noted that a rise of intense socio-spatial disparities and spatial segregation (Marcinczak et al.,

2013; Temelova et al., 2011) together with the suburbanisation process (Kurek et al., 2015) belong to the leading processes that have been influencing urban development in Eastern Europe in the last two decades. Lastly, the shifting political-economical orientation of Eastern Europe from communism to market-oriented liberal democracies has opened up an opportunity to understand better the perceptions of general public towards the success of a brownfields regeneration project and how those voices might be integrated into brownfields reuse planning.

2.2 The need for “sustainable” regeneration of brownfields

Some argue that the “best” regeneration from an economic point of view is usually the demolition of brownfields and further redevelopment of these areas by the building of new commercial facilities or houses, especially in and close to the city centres (Kunc et al., 2012).

The changing economic value of a brownfields site is an important indicator, however, the social, environmental and symbolic values of brownfield sites are also of a great importance so that the quality of life of the local population could be improved, and more sustainable and balanced urban development could be reached. The symbolic values of brownfields as elements of heritage (Berg and Stenbro, 2015; Rypkema, 2009) deserve to be discussed more deeply. Since these sites or buildings were an integral part of industrial cities for decades and served as areas of production where the local people were commuting to work, a local settlement was formed around them and local people experienced these sites in their everyday lives, certain emotional relations of the local population towards individual brownfields developed over the time. Even though an industrial operation was ended and the sites were abandoned, it does not necessarily mean that such mental relation to brownfields has been lost. Conversely, the mentioned relation might be systematically used for the development and strengthening of the local identity (Ruelle et al., 2013).

It is understandable that the existence and everyday life with brownfields in one's neighbourhood brings completely new experiences both for the local population and the local government. In the event that uncertainty and unfamiliarity prevails in the scheme of such coexistence many problems in the field of decision making can arise (Frantal et al., 2015; Peric, 2011). It has to be taken into account that contemporary brownfields have been intensively utilized for decades, thus relations of stakeholders to the phenomena of abandoned (possibly contaminated) spaces or buildings are relatively limited and the sophisticated managerial tools for the decision making are still not widespread (Alexandrescu et al., 2017; Limasset et al., 2018; Pizzol et al., 2016; Reisinger et al., 2017). This can lead to faulty decisions and the failure of regeneration (Liu et al., 2017; Medda et al., 2012; Wedding and Crawford-Brown, 2007). Even though attention is often paid to successful regenerations detailed analyses confirm that the costs of regeneration, especially in commerce, are inefficient (Kim and Jang, 2017) and analyses of such failed regenerations can help in the decision making in other areas (Dixon, 2007). Insufficient planning is often blamed for the failure of regeneration, however, many extremely successful regenerations in the absence of any planning can be found (Cheng et al., 2011).

When confronted with hurdles to the reuse of brownfields, one possibility is to build a reuse plan around temporary uses. This notion of temporary uses of brownfields might at least contribute to an improvement of the image of these sites and thus increase chances for “real” regeneration (Rall and Haase, 2011).

The “temporariness” of regeneration should be taken into account also for intended “final” regeneration (from the present point of view). There are plenty of options for the use of brownfields that fulfil the requirement of “temporariness” (Moss, 2003). They are, however, highly dependent on its technical state, location or health and safety connected issues (Haase, 2008). The temporary use of brownfields might be linked to an organisation of cultural or sport events (Andres, 2011), the use of brownfields for renewable energy production such as location of solar plant or growing of biomass (Adelaja et al., 2010; Evangelou et al., 2012; Klusacek et al., 2014), the projects of urban agriculture (Duzi et al., 2017; Koopmans et al., 2017; LaCroix, 2010) or the use of brownfields for leisure time of the local population or tourism (Zhang and Klenosky, 2016).

2.3 Visitors perception of brownfield regeneration

The issue of opinions of residents or visitors, with the exception of brownfield development into recreational grounds (Zhang and Klenosky, 2016), is mentioned rather sparsely in the brownfield redevelopment literature. It seems that community attitudes to brownfield regeneration projects are positive and a creation of multifunctional areas is the most preferred (Loures et al., 2016). Nevertheless, any alternative of revitalisation is positively appraised by the respondents (Maliene et al., 2012), even though long-term residents can view any “change” as a potential threat to the existing social relations (Raco et al., 2008).

The impact of visitor characteristics on attitudes to brownfield regeneration projects has been studied by Loures et al. (Loures et al., 2016). They examined gender, age, education level and income of respondents. They found great differences in perception especially regarding culture and safety among age categories as well as gender. This study also suggests that there are important differences in perception of brownfields as seen by population groups with various levels of individual mobility and with various places of residence. Kunc et al. (2014) found that women are more sensitive towards environmental risks and that younger respondents are more tolerant regarding drug dependency issues. The distance from the place of permanent residence to the studied area shows correlation in the perception of air contamination by responders. However, gender, as well as age, was found not to be statistically important for preferences. Maliene et al. (Maliene et al., 2012) studied the comparison of two waterfront brownfields – Liverpool, UK and Cologne, Germany. The questionnaire survey shows that regeneration is perceived in both cities as something generally positive, but a different level of satisfaction was identified – the results from Cologne were not as conclusive as those from Liverpool. Generally, the German public doubted that any of the city’s economic and social factors would greatly benefit from the brownfield regeneration. Doucet et al. (Doucet et al., 2011) found spatial proximity to be the key factor influencing the perception of particular brownfield regeneration. Strong feelings of attachment towards a new flagship would diminish with older age groups.

A complex set of factors influence the preferences for a wide spectrum of brownfield regeneration possibilities (Martinat et al., 2017). They found both place of living as well as characteristics of respondents (gender, age) to be statistically important for different types of brownfield regeneration.

The existing experience shows that the spatial aspect of revitalized brownfield, as well as the origins and social characteristics of respondents, are important when analysing the possibilities of further reuse of brownfields.

3. Brownfield property under study

The area of Landek is located in the city of Ostrava in the eastern part of the Czech Republic near the border with Poland and circa 70 kilometres west of the border with Slovakia. The whole region is significantly influenced by a long-term heavy industrialization and coal mining, which have taken place here for more than 150 years. The beginnings of large scale heavy industry and mining can be traced in this area to the first quarter of the 19th century, which resulted in a huge labour in-migration to the area of Ostrava and massively changed the area's social and economic structure. Here, urban development has been concentrated more around mines and factories than around the city centre in contrast to traditional cities. After decades of massive exploitation of coal resources during the Communist era (1948-1989), when mining and heavy industry had been treated by the Communist leaders as the heart of the country's economy, the mining in the area of Ostrava was discontinued in the mid-1990s. In this period when plenty of local miners and heavy industry workers lost their jobs, social problems connected to high unemployment appeared. Together with de-industrialization huge amounts of brownfields in the area occurred as a consequence of quick economic transition to market economy in Eastern Europe. Currently, heavy industries are still located in the area of Ostrava, however, their scale is much reduced and their further reductions are expected in near future. Concentration of heavy industry in Ostrava and proximity to industrial and mining areas in Poland causes heavy air pollution that is one of highest in the European Union countries. Strong efforts have been devoted to regeneration of numerous brownfields for various purposes (Rumpel et al., 2013) . Nowadays, the population of Ostrava is around 292 thousand (2016) but due to above mentioned social and environmental problems city is losing its population in favour of other, economically booming regions of the Czech Republic.

The area of the Landek Hill is located in the northern part of Ostrava in the Petrkovice city district near the confluence of the Ostravice River and the Odra River, where coal mining was recorded for the first time in the region in the late 18th century. It is said that by the discovery of coal at the Landek Hill, the story of coal and industry in Ostrava was commenced. The area is located circa seven kilometres north of the city centre, well accessible by transport which creates good opportunity to be visited by both local Ostrava population and tourist.

In the Landek area, the Anselm Mine for coal mining was in operation from the 1840s until the early 1990s. At the site of this mine and close neighbourhoods, the largest museum of mining in the Czech Republic was founded in 1993. Together with the amusement park (the Landek Park), where facilities for leisure-time activities are located, it covers an area of 35 hectares (see Figure 1), which is visited by more than 100 thousand visitors annually.

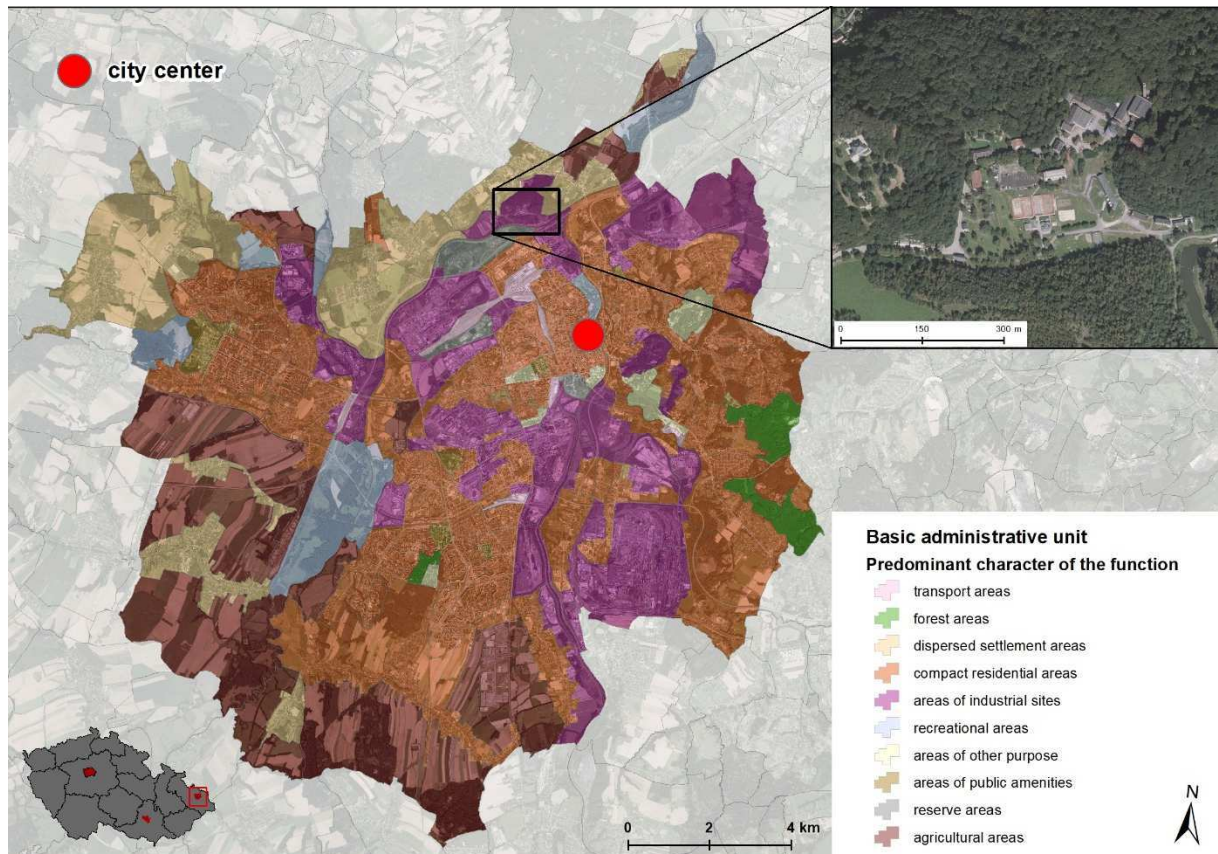


Figure 1. Location of the Landek area within Ostrava (Czech Republic)
 Source: ©ArcČR, ARCDATA PRAHA, ZÚ, ČSÚ, 2016; ČÚZK, 2017

4. Methods

The data necessary to fulfil the objective of the paper were collected among visitors of successfully regenerated brownfield sites in Landek via semi-structured interviews.

4.1 Questionnaire

Detailed review of studies performed on the regeneration of brownfields and their perception was the first step of the research. Questions for the questionnaire were based on literature mentioned in the section 2 of this paper. The questionnaire consists of three parts.

The first part is aimed at gathering the data regarding our first research question. Thus, it is focused on the problem of the perception of “success” of the existing regeneration (as the amusement park). The respondents were asked to reply to the level of satisfaction with the aesthetic and functional state of present regeneration. The satisfaction was measured on a five-point scale (ranging from 1 = definitely not satisfied to 5 = definitely satisfied).

The second part offers seven possibilities for the reuse of present brownfield, to help us answer our second research question. The seven types of reuses are: (i) culture/sport, (ii) children amusement park, (iii) industry, (iv) offices, (v) shopping mall, (vi) housing and (vi) parking. The level of preferences for each type was measured on a five-point scale (ranging from 1 = definitely not preferred to 5 = definitely preferred).

The last part of questionnaire is aimed to collect information regarding the respondent – age (continuous variable: the number of years), gender (bivariate variable: male, female), education (continuous variable: the number of years in education), place of residence

(nominal variable: local city district Ostrava-Petřkovice, other city districts of Ostrava, other cities/municipalities in the Moravian Silesian Region, other regions of the Czech Republic), occupation of the respondent (nominal variable: students, employees, entrepreneurs, retired persons, persons on maternity and parental leave), and the knowledge that the site is a revitalized brownfield (bivariate variable: yes, no).

4.2 Data collection and the sample

As was mentioned above, the data were gathered by means of anonymous semi-structured interviews. The verification of comprehensibility of individual questions was carried out through a pilot testing of the instrument with 10 respondents during June 2014. The questionnaires were collected in the period between July 2014 and November 2014. Altogether, 195 respondents older than 18 years participated in the survey. They were all interviewed face-to-face at the Landek amusement park. Each interview lasted between fifteen to twenty minutes. The share of refusals to participate in the survey was around 30 %. One group of respondents refused to participate as they did not wish to be disturbed in their free time, others argued that they recently already participated in other surveys. In our analyses below, we work with a sample of 180 questionnaires as 15 questionnaires were unusable for our research.

Out of 180 respondents, 58.9 % were women (106) and 41.1 % were men (74). The age of two-thirds of the respondents was between 18 and 34 years. This skewing towards young women is likely due to the attractiveness of the Landek amusement park with its leisure time activities and orientation towards young families. The share of older respondents is significantly lower (around 6 %) and corresponds with general demographic patterns of visitors to amusement parks, confirmed during the preparatory phase of the research. From the point of view of educational background, respondents with a secondary education with graduation were the majority (61.1 %), respondents with a secondary education without graduation and those with a university education are both equally represented (at around 17 %). Three-fifths of the respondents come from another city or municipality than that of Ostrava, yet from the same region, only 3 % are from other regions of the Czech Republic. More than one-third of the respondents come from Ostrava, where Landek is located, and around 9 % are from the local city district Petřkovice. Regarding the type of the economic activity, two-fifths of the respondents are represented by students and one-third by employees. Entrepreneurs and retired persons both represent 9 %. More data on segmentation of our sample can be found in Table 1.

Table 1. The structure of the group of respondents of the survey (n = 180).

Age structure	18-24 years	50 %
in 10 years	25-34 years	16.7 %
intervals	35-44 years	9.4 %
	45-54 years	11.6 %
	55-64 years	5.6 %
	65 years and older	6.7 %
Gender	female	58.9 %
structure	male	41.1 %
educational	elementary	4.4 %
structure	secondary without graduation	17.2 %
	secondary with graduation	61.1 %
	tertiary	17.3 %
Place of	local city district Ostrava-Petřkovice	8.9 %
residence	Ostrava (other city districts)	28.9 %
	other cities/municipalities in the Moravian Silesian Region	59.4 %

Type of economic activity	other regions of the Czech Republic	2.8 %
	students	44.4 %
	employees	35 %
	entrepreneurs	8.3 %
	retired persons	9.5 %
	persons on parental leave	2.8 %

Source of data: Questionnaire survey (n=180), Authors processing

4.3 Data analyses

Firstly, data regarding the satisfaction of respondents were organized and examined using descriptive statistics. The potential difference between satisfaction with aesthetical and functional regeneration was tested by the means of nonparametric Wilcoxon test, as data are paired and do not possess the normal distribution. The Spearman rank correlation coefficient was further used to reveal potential correlation among the two factors of satisfaction and respondent related variables.

We began our analysis of preferences with the correlation between satisfaction and preferences data (the Spearman rank correlation coefficient). The Friedman test was used to compare the level of preferences among types of re-reuse, as the preferences were considered not to be completely independent one from each other. As we intended to find out the main forces shaping the structure of preferences for re-reuse of brownfield, multivariate analysis techniques were used. The structure of preferences was tested against a characteristic of respondents, thus first the unconstrained method and consequently the constrained method was used.

Principal component analysis (PCA) and Correspondence analysis are main unconstrained methods for such an assessment (Quinn and Keough, 2002). The use of one of those methods is given particularly by the identified length of gradient calculated in multiples of the standard deviation (ter Braak and Smilauer, 2012). In our case, the length was 1.0; we have thus used PCA. To make the responses for dependent variables relative, the preferences were centred prior to the analyses. Since our objective is not only to assess the structure behind the preferences for the particular type of brownfield re-reuse but primarily to identify the relation of this structure on the character of respondents, the potential link between the structure of preferences and all studied independent variables was assessed by biplot (ter Braak and Smilauer, 2012). This kind of graph allows us to assess the mutual relation among explained variables and explaining variables that are passively projected into coordinates that are given by the structure of the explained variables. However, this type of biplot based on results of PCA analysis of dependent variables is only a graphic representation without any possibility of statistical testing of the relations. In case we would like to test those relations, the employment of an unconstrained method is necessary. For this reason, the relation between the structure of dependent variables and the structure of independent variable was tested using Redundancy analysis (RDA), which is a constrained variety of PCA analysis (Leps and Smilauer, 2003). Since we assume not all measured independent variables have to be statistically significant for the structure of preferences for brownfields re-reuse, the RDA model encompassed only those variables contributing statistically significantly to the degree of explained variance of dependent variables. Thus, the forward selection of independent variables was used. Statistical significance was tested using Monte Carlo permutation test (ter Braak and Smilauer, 2012) that is based on testing a hypothesis of the non-existence of differences between the structure of collected data and the structure of randomly arranged values of data (Good, 1995); 999 permutation (i.e.999 randomly arranged data) was used.

The PCA and RDA were performed by algorithms of the CANOCO 5 package (ter Braak and Smilauer, 2012), Wilcoxon test, Friedman test and Spearman rank correlation coefficient by Dell Statistica 13.0.

5. Results and Discussion

5.1 Satisfaction with present reuse of brownfield

To answer our first research question, the respondents were asked to evaluate the current state of Landek amusement park as the former brownfield from the point of view of its aesthetics and functionality. The functionality of Landek is evaluated slightly more positively than is its aesthetics. More respondents perceived the functionality better in category “very good” as well as in “good” and “neutral” (Figure 2). This difference is statistically significant (Wilcoxon test = 2.168; $p < 0.05$).

This leads us to the assumption that respondents prefer the functionality of the site to the aesthetics of the regenerated brownfields to some extent. Such result is important for the context of the Eastern European countries as, due to a lack of financial resources, a plenty of brownfields are regenerated gradually (Kunc et al., 2014a) for a long time depending on the financial situation of the owner, which presupposes significant patience of visitors. The functionality goes first in many cases; however, if functionality meets the aesthetical values, the satisfaction of visitors is higher, as is shown by reuse case studies in Brno, Czech Republic (Navratil et al., 2017). In contrast, in the case of post-socialistic cities “something” is better than the present state (Rall and Haase, 2011). Our results might mirror the attitudes of respondents to satisfaction with the given element, but general dissatisfaction with the overall realization of the regeneration project. To paraphrase the frequent opinion of the respondents – we are happy that the amusement park is here instead of the defunct mine, but the final results of the regeneration could have been done better (Weiermair and Fuchs, 1999).

As previous studies show (Doucet et al., 2011; Martinat et al., 2017) the influence of independent variables like gender and income on the perception on brownfield regeneration is expected, the correlation among satisfaction and all measured segmentation variables, however non-influence was found (all the Spearman rank correlation coefficients were only of small level and not statistically significant).

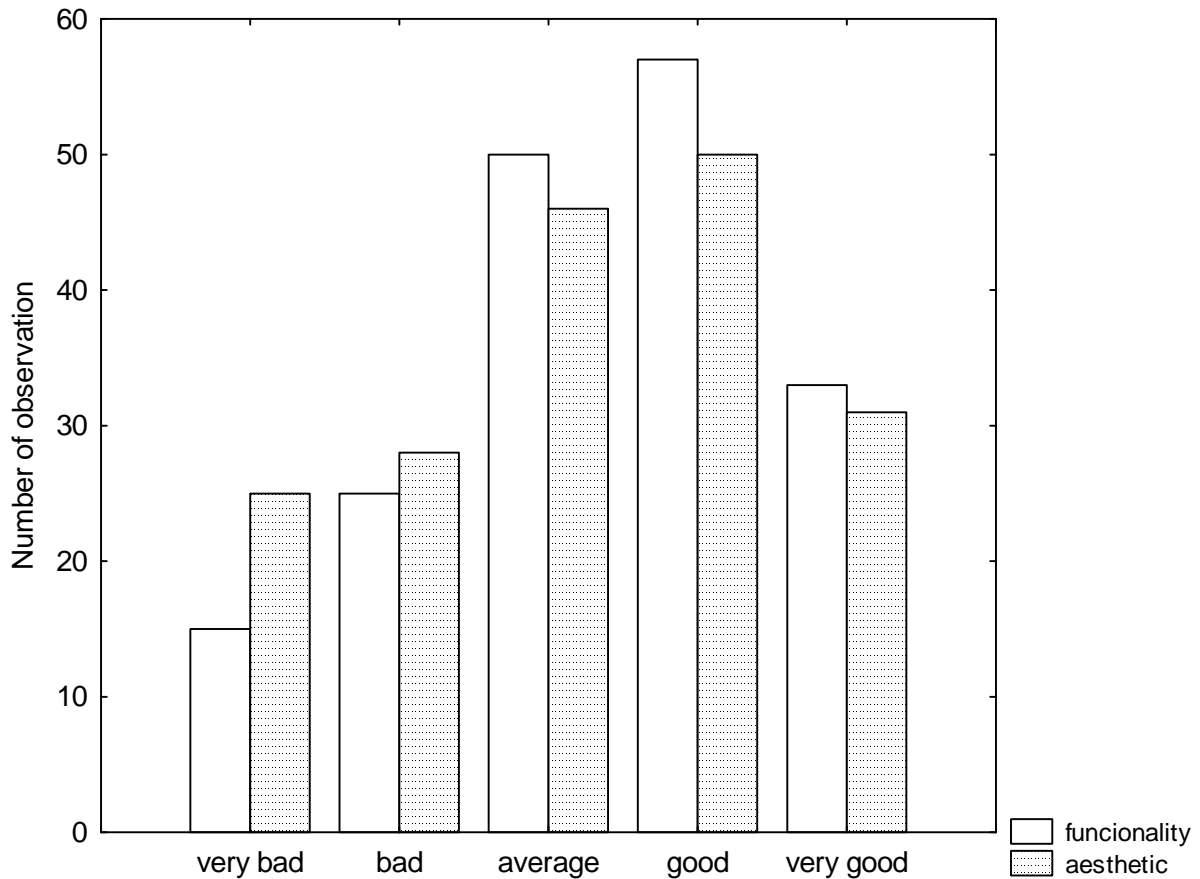


Figure 2. The evaluation of the Landek Park from aesthetical and functional perspectives by the visitors.

Source of data: Questionnaire survey (n=180), Authors processing

5.2 Structure of preferences for re-reuse of brownfield

As it is supposed that every site should be reused in future in some way, the respondents were also asked to evaluate other possible future uses of the Landek area to answer our second research question. The preferences for re-reuse options were found to be independent of satisfaction with both aesthetics and functionality of present reuse (all the Spearman rank correlation coefficients were only of the small level and not statistically significant). However great differences in preferences for different re-reuse options were found (Friedman ANOVA Chi-square = 279.892; d.f. = 6; $p < 0.001$; Figure 3). The mean ranks for each preferred use are: sport/culture (5.56), children's amusement park (5.21), housing (3.76), industry (3.73), parking (3.53), offices (3.47), and shopping mall (2.76).

Thus, all the re-reuse possibilities are not comparably popular – some of the re-reuse options were measured as lower in comparison to other options. This might be stressed as a difference from the current usual attitude of the population towards brownfields regeneration where almost all regeneration options are welcome (Duzi and Jakubinsky, 2013; Kunc et al., 2014b). It has to be mentioned that very low support was recorded, with respect to shopping malls and offices. This might be caused by a saturation of the local real estate market by shopping malls and offices that have been primarily developed in the last two decades on greenfields (Nekolova et al., 2016; Novosak et al., 2013). Very few of these uses have been developed on brownfields (as it is the case of the New Karolina shopping centre that is located at the edge of the Ostrava inner city).

It seems that other reuse options are not so popular, yet, a rather high evaluation of the industry re-reuses could be of interest. The relatively high preference for industry option might be caused by the industrial tradition of the wider region (Nekolova et al., 2016) and/or a relatively higher level of unemployment among the lower qualified population of Ostrava region (Mulkova et al., 2016). This effect was found before for the Ostrava city (Martinat et al., 2015) as well as for nearby Karvina mining region (Martinat et al., 2016; Martinat et al., 2017), however, in this study we are focusing on regenerated brownfields and on attitudes of predominantly young visitors. The interest of the population of Ostrava metropolitan area in industry re-reuse is thus high, as it is in Karvina, as earlier summarized by Martinat et al. (Martinat et al., 2016): “lack of other job opportunities for less qualified people means that mining is perceived as the most stable job regardless of the anticipated exhaustion of the reserves in the next two decades.” The same statement counts here for industry (it means heavy industry here) in the case of Landek. Even though Landek is already a regenerated brownfield and a majority of visitors are satisfied with this regeneration, the preferences for further reuse that is completely different than the present is very high. It seems that the support, especially for re-industrialization or trans-industrialization (Krzysztofik et al., 2016) in our structurally affected region, is high and perceived as needed.

The most favourite use for Landek is its contemporary use as the “culture/sport” and “amusement park”. We can stress that it is quite hard for many respondents to imagine an alternative future use of the site. On the other hand, decades ago when the site was used for coal mining, it was hardly predictable that the site will be reused for culture and sport in near future. The reasoning behind this logic lies in the hypothesis that the needs and preferences of the population in future concerning the reuse of the sites could be quite different than today. This leads us to an assumption that the future re-reuse is hardly predictable.

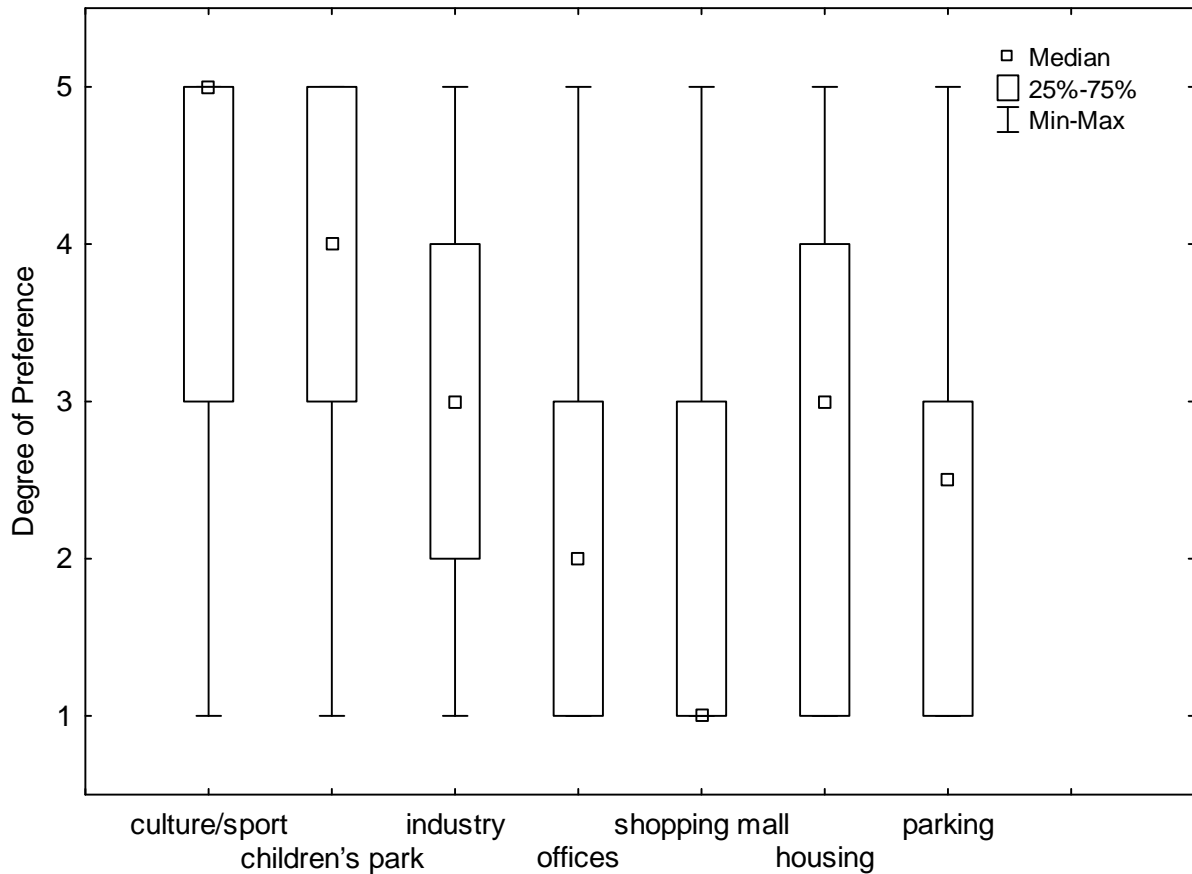


Figure 3. Medians, quartiles and min-max range of preferences of further re-use options of the Landek Park by its visitors

Source of data: Questionnaire survey (n=180), Authors processing

The results of the analysis showed us that the preferences for different reuses are greatly diversified. Respondent did not point out one of the proposed possibilities but valued their preferences for each alternative. This is the reason why we can study the structure of preferences among respondents and a further test of dependency of this structure on the segmentation criteria measured by the means of multivariate statistical techniques.

Table 2. The summary of PCA and RDA.

	Axis	PCA	RDA
Eigenvalues	1 st	0.357	0.018
	2 nd	0.199	0.355
	3 rd	0.118	0.187
	4 th	0.099	0.117
(Pseudo-)canonical correlations	1 st	0.257	0.297
	2 nd	0.274	-
	3 rd	0.193	-
	4 th	0.315	-
Explained cumulative (%)	1 st	35.7	1.8
	2 nd	55.7	-
	3 rd	67.5	-
	4 th	77.4	-

Source of data: Questionnaire survey (n=180), Authors processing

As usual in these studies, the two first PCA axes were found to be the most important (Table 2, Figure 4). Together, they explain more than a half of the total variance of the dependent variables (we had “only” seven dependent variables). The total explained variance by explanatory variables is 6.3 %. The two distinct components were separated along the two first axes. The first one can be called the “re-new production” axis, as industry, offices, shopping mall and parking reuse are heavily loaded here. The second axis may be labelled “entertainment”, as the amusement park and cultural/sports use were loaded on this axis. Thus, it seems that the respondents decided on their preferences for the individual re-use of the site according to two criteria that are re-new production and entertainment. These two ways of regeneration belong, together with a housing option, to a more preferred option of the brownfields regeneration (Figure 3).

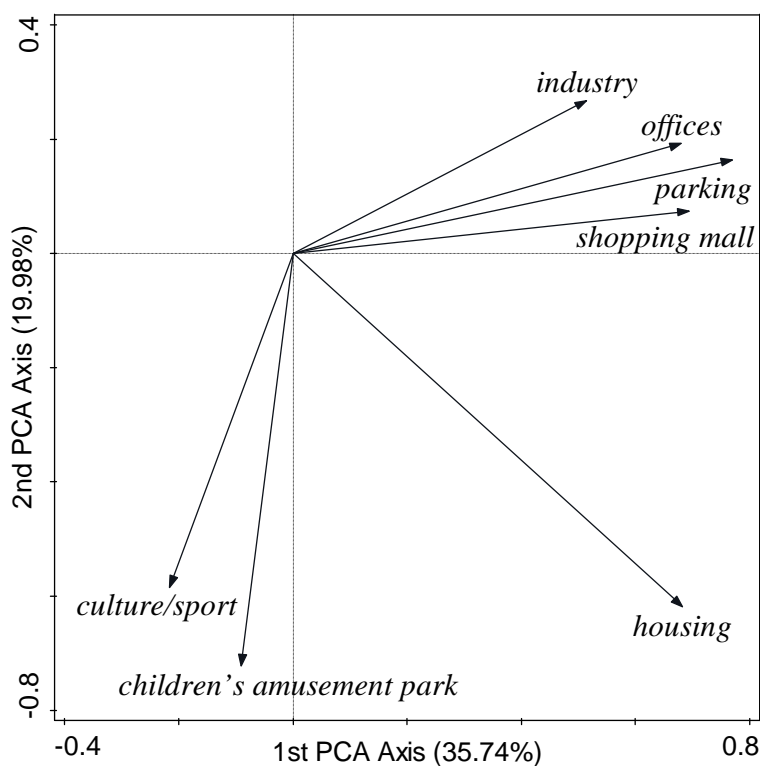


Figure 4. PCA ordination plot with dependent variables shown.
Source of data: Questionnaire survey (n=180), Authors processing

From the position of segmentation criteria in ordinal space given by preferences, we can state that the group of respondents that are less satisfied with the aesthetic and functional state of the revitalisation (Figure 5) shows preference for the “re-new production” component in the preferences structure. Such type of further development is also favoured by respondents from outside the city, as well as by males, younger respondents, and those who understand that this site has been already revitalized. The “entertainment” utilization is perceived positively especially by females and those, who did not know, that this site is former brownfield. Housing was denoted as single item component underling its special position in brownfield regeneration issue as pointed out before in similar circumstances by Krzysztofik et al. (Krzysztofik et al., 2012).

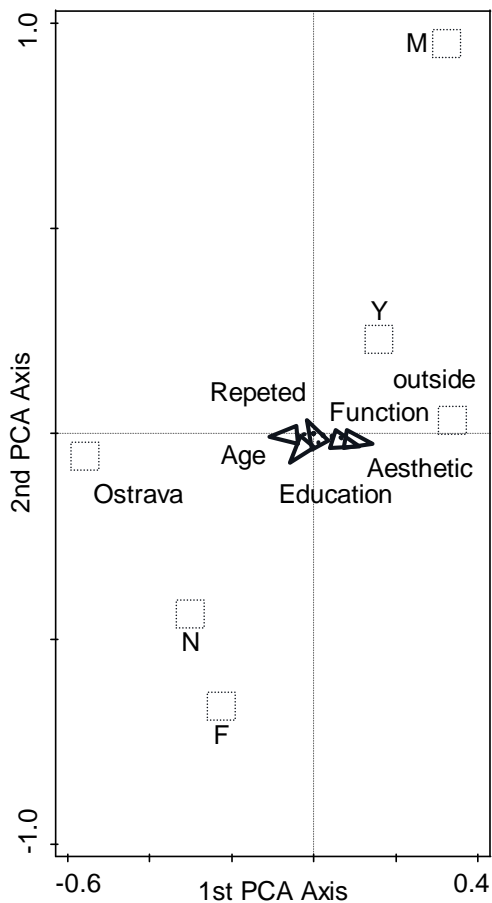


Figure 5. PCA ordination plot with passively projected independent variables.
 Source of data: Questionnaire survey (n=180), Authors processing
 Notes: M = male, F = female, Y = I know this site is revitalized brownfield, N = I do not know this site is revitalized brownfield.

However, the linkage between the structure of preferences and all independent variables must be tested to find which independent variables are “really” important for the structure revealed by PCA – so RDA with forward selection of variables followed. The model has chosen gender as a statistically important variable for the structure of preferences (note that two clear components of the structure were identified by PCA). The first axis of RDA is statistically significant (pseudo F-ratio = 3.287; $p = 0.011$). Regardless of a quite small value of Eigenvalue, the position of males and females are very similar in PCA and RDA ordination diagrams (see Figure 4, 5, and 6). Thus, gender could be considered as a statistically important and reasonable factor of differentiation of preferences for re-reuse of the brownfield under study. Women, unlike men, strongly supported the leisure time re-reuse option. The ties between gender and leisure time re-use options are reported for reuse option, too (Martinat et al., 2017) as well as the strong position of gender when deciding about ways for the further development of with deindustrialization affected region (Martinat et al., 2014). The gender point of view is also obvious in the support for the industry re-use. Refusal of this re-use option was stronger among women than among men. This might be caused by usually different attitudes of women towards aesthetically no so nice buildings, or by a different perception of potential risk (Gustafson, 1998).

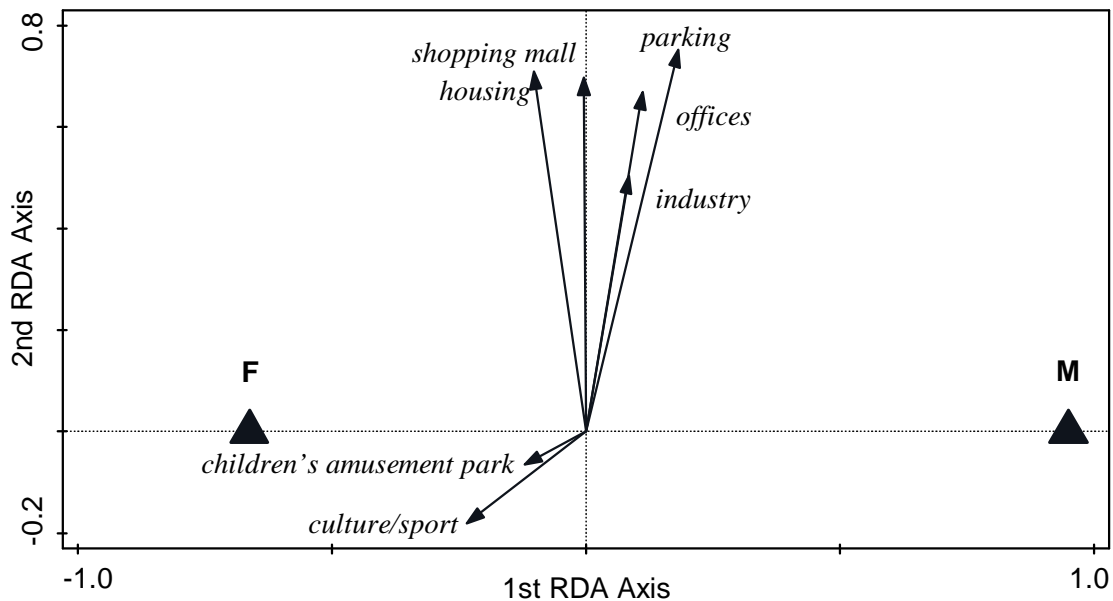


Figure 6. RDA ordination plot with dependent variables and gender included into the model. Source of data: Questionnaire survey (n=180), Authors processing

6. Conclusion

The occurrence of brownfields in the cities of Eastern Europe is high and where many of such sites exist, a competition among individual sites to be regenerated is obvious. Not all brownfields can be regenerated in the near future and some of them will be left for a later regeneration. It is an open question as to whether the current uses of regenerated brownfields will meet the needs and demands of the future.

In our research, we examined how the Landek brownfield redevelopment was perceived by visitors. We have stated two research questions: “What is the level of satisfaction with present reuse of brownfield?” and “What are the main forces shaping the structure of preferences for re-reuse of brownfield?”

We have found that the functionality is slightly more positively evaluated than its aesthetics. Thus, respondents are satisfied with one dimension, but generally dissatisfied with the overall realization of the regeneration project. There is no correlation between satisfaction and preferences to possible reuses of the area. Two general reuse strategies were found, which were labelled as “re-new production” and “entertainment”. Gender was found as independent variable important for diversification between those two ways of re-use. Our findings have many practical implications, some theoretical, but also limitations that will be discussed further.

6.1 Practical implications of study results

Despite the *prima facie* success of the Landek regeneration, with its diverse activities and more than 100,000 visitors each year, the satisfaction is not very high – 22% of visitors are unsatisfied with the technical conception of the site’s regeneration and even 30% are unsatisfied with the aesthetic values of the regeneration, both dissatisfactions are independent on type of visitor. We can infer that many of visitors could imagine “better”

realization of current regeneration and could positively perceive another reuse or welcome another type of re-reuse. Thus, re-reuse is not unimaginable, at least for not a negligible number of current visitors.

Although the current reuse was expensive and needed to overcome a number of technical hurdles, the reuse outcome is not satisfactory for many. The great preferences for current uses (sports and culture, children's park) can be deemed as expected and unsurprising. In contrast, surprising high values of preferences for housing and especially industry are surprising, particularly for the latter case. We have shown earlier that the preferences for the industry relate to circumstances of general economic decline in the whole region. However, it is important to note that for almost 10% of respondents the industrial reuse is the best solution for a present amusement park. Also, the reuse for housing is economically unimaginable in current state and for almost 20% of visitors, it is the second best solution. We have also found that different types of reuse are considered by respondents in "structure" that is influenced by gender. Thus, the preferences have a gender dimension. While men predominantly supported reuses for industry, offices, a shopping mall and a parking place, women voted for the amusement and cultural/sport reuses (which is the contemporary use of the site).

6.2. Theory implications and limitations of the present study

Our knowledge on the perception of alternative reuse options of brownfields is an important contribution to studies based on problems connected with brownfields reuse regeneration. Preferences for re-reuse are made by many respondents without taking into account present use of former brownfield. It emerges as a potentially important field of study within the brownfield phenomenon.

We can conclude that reuse possibilities of brownfields are important for visitors of already reused brownfields. The interest in future reuse is diverse and forecasting of future trajectories of development is possible, however, their accuracy is questionable. Thus the planning process could include these perceptions and opinions into the consideration of future re-reuse possibilities. After navigating through a monumental shift in public decision-making at the end of the last century, Eastern European countries are now well-positioned to find ways to listen better to public opinions and perceptions – something this research contributes to both methodologically and substantively.

However, our result can be affected by the selected site. It is especially the case of the specific "post-industrial" area as well as the type of reuse – amusement park. Further research on the impact of the locational circumstances of the site as well as the type of regeneration in different economic realms is needed and should be further examined.

Acknowledgement

Our research was kindly supported by the projects Brownfields in urban and rural space: geographic, economic, historical, legal contexts and their importance for regional development (BURAN) (SGS/21/2016), Local development through local action groups: agriculture, local production, tourism and community management (FRRMS IGA 2017/020), by the institutional funding of the University of the South Bohemia (J.N.), Palacky University Olomouc and Tomas Bata University (J.T.). Final stages of our work were also supported by the COFUND Fellowship (S.M.) that is funded by Cardiff University, Welsh Government and the European Commission. We are truly grateful for comments of all reviewers.

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